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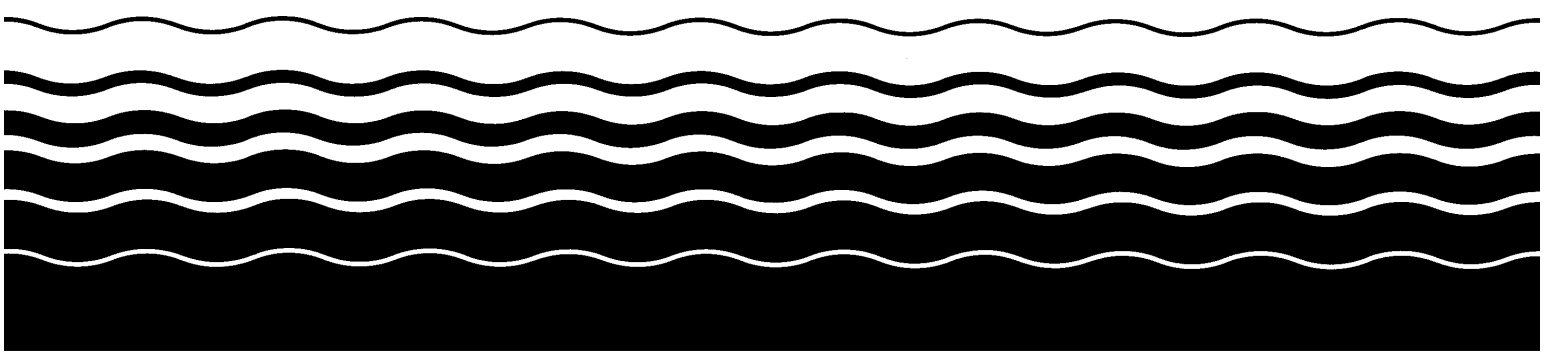
Development Document for Final Effluent Limitations Guidelines and Standards for the Landfills Point Source Category



DEVELOPMENT DOCUMENT
FOR
FINAL EFFLUENT LIMITATIONS
GUIDELINES AND STANDARDS
FOR THE
LANDFILLS
POINT SOURCE CATEGORY

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1.0 LEGAL AUTHORITY

1.1 Legal Authority

Effluent limitations guidelines and standards for the Landfills industry are promulgated under the authority of Sections 301, 304, 306, 307, 308, 402, and 501 of the Clean Water Act, 33 U.S.C. 1311, 1314, 1316, 1317, 1318, 1342, and 1361.

1.2 Background

1.2.1 Clean Water Act (CWA)

The Federal Water Pollution Control Act Amendments of 1972 established a comprehensive program to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Section 101(a)). To implement the Act, EPA is to issue effluent limitations guidelines, pretreatment standards, and new source performance standards for industrial dischargers. These guidelines and standards are summarized briefly in the following sections.

1.2.1.1 Best Practicable Control Technology Currently Available (BPT) (Section 304(b)(1) of the CWA)

In the guidelines for an industry category, EPA defines BPT effluent limits for conventional, priority,[1] and nonconventional pollutants. In specifying BPT, EPA looks at a number of factors. EPA first considers the cost of achieving effluent reductions in relation to the effluent reduction benefits. The Agency also considers: the age of the equipment and facilities; the processes employed and any required process changes; engineering aspects of the control technologies; non-water quality environmental impacts (including

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[1] In the initial stages of EPA CWA regulation, EPA efforts emphasized the achievement of BPT limitations for control of the "classical" pollutants (e.g., TSS, pH, BOD_5). However, nothing on the face of the statute explicitly restricted BPT limitation to such pollutants. Following passage of the Clean Water Act of 1977 with its requirement for points sources to achieve best available technology limitations to control discharges of toxic pollutants, EPA shifted its focus to address the listed priority pollutants under the guidelines program. BPT guidelines continue to include limitations to address all pollutants.

energy requirements); and such other factors as the Agency deems appropriate (CWA 304(b)(1)(B)). Traditionally, EPA establishes BPT effluent limitations based on the average of the best performances of facilities within the industry of various ages, sizes, processes or other common characteristics. Where, however, existing performance is uniformly inadequate, EPA may require higher levels of control than currently in place in an industrial category if the Agency determines that the technology can be practically applied.

1.2.1.2 Best Conventional Pollutant Control Technology (BCT) (Section 304(b)(4) of the CWA)

The 1977 amendments to the CWA required EPA to identify effluent reduction levels for conventional pollutants associated with BCT technology for discharges from existing industrial point sources. In addition to other factors specified in Section 304(b)(4)(B), the CWA requires that EPA establish BCT limitations after consideration of a two part "cost-reasonableness" test. EPA explained its methodology for the development of BCT limitations in July 1986 (51 FR 24974).

Section 304(a)(4) designates the following as conventional pollutants: biochemical oxygen demand (BOD_5), total suspended solids (TSS), fecal coliform, pH, and any additional pollutants defined by the Administrator as conventional. The Administrator designated oil and grease as an additional conventional pollutant on July 30, 1979 (44 FR 44501).

1.2.1.3 Best Available Technology Economically Achievable (BAT) (Section 304(b)(2) of the CWA)

In general, BAT effluent limitations guidelines represent the best economically achievable performance of plants in the industrial subcategory or category. The factors considered in assessing BAT include the cost of achieving BAT effluent reductions, the age of equipment and facilities involved, the process employed, potential process changes, and non-water quality environmental impacts, including energy requirements. The Agency retains considerable discretion in assigning the weight to be accorded these factors. Unlike

BPT limitations, BAT limitations may be based on effluent reductions attainable through changes in a facility's processes and operations. As with BPT, where existing performance is uniformly inadequate, BAT may require a higher level of performance than is currently being achieved based on technology transferred from a different subcategory or category. BAT may be based upon process changes or internal controls, even when these technologies are not common industry practice.

1.2.1.4 New Source Performance Standards (NSPS) (Section 306 of the CWA)

NSPS reflect effluent reductions that are achievable based on the best available demonstrated control technology. New facilities have the opportunity to install the best and most efficient production processes and wastewater treatment technologies. As a result, NSPS should represent the most stringent controls attainable through the application of the best available control technology for all pollutants (i.e., conventional, nonconventional, and priority pollutants). In establishing NSPS, EPA is directed to take into consideration the cost of achieving the effluent reduction and any non-water quality environmental impacts and energy requirements.

1.2.1.5 Pretreatment Standards for Existing Sources (PSES) (Section 307(b) of the CWA)

PSES are designed to prevent the discharge of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of publicly owned treatment works (POTWs). The CWA authorizes EPA to establish pretreatment standards for pollutants that pass through POTWs or interfere with treatment processes or sludge disposal methods at POTWs. Pretreatment standards are technology-based and analogous to BAT effluent limitations guidelines.

The General Pretreatment Regulations, which set forth the framework for the implementation of categorical pretreatment standards, are found at 40 CFR Part 403. These regulations contain a definition of pass

through that addresses localized rather than national instances of pass through and establish pretreatment standards that apply to all non-domestic dischargers (see 52 FR 1586, January 14, 1987).

1.2.1.6 Pretreatment Standards for New Sources (PSNS) (Section 307(b) of the CWA)

Like PSES, PSNS are designed to prevent the discharges of pollutants that pass through, interfere-with, or are otherwise incompatible with the operation of POTWs. PSNS are to be issued at the same time as NSPS. New indirect dischargers have the opportunity to incorporate into their plants the best available demonstrated technologies. The Agency considers the same factors in promulgating PSNS as it considers in promulgating NSPS.

1.2.2 Section 304(m) Requirements

Section 304(m) of the CWA, added by the Water Quality Act of 1987, requires EPA to establish schedules for (1) reviewing and revising existing effluent limitations guidelines and standards ("effluent guidelines") and (2) promulgating new effluent guidelines. On January 2, 1990, EPA published an Effluent Guidelines Plan (55 FR 80) that established schedules for developing new and revised effluent guidelines for several industry categories. One of the industries for which the Agency established a schedule was the Hazardous Waste Treatment Industry.

The Natural Resources Defense Council (NRDC) and Public Citizen, Inc. filed suit against the Agency, alleging violation of Section 304(m) and other statutory authorities requiring promulgation of effluent guidelines (NRDC et al. v. Reilly, Civ. No. 89-2980 (D.D.C.)). Under the terms of the consent decree in that case, as amended, EPA agreed, among other things, to propose effluent guidelines for the "Landfills and Industrial Waste Combusters" category by November 1997 and final action by November 1999. Although the Consent Decree lists "Landfills and Industrial Waste Combusters" as a single entry, EPA is publishing separate regulations for Industrial Waste Combusters and for Landfills.

2.0 SUMMARY AND SCOPE

2.1 Introduction

The final regulation for the Landfills industry establishes effluent limitations guidelines and standards for the control of wastewater pollutants. This document presents the information concerning, and rationale supporting, these effluent limitations guidelines and standards. Section 2.2 discusses the subcategorization approach, Section 2.3 describes the scope of the regulation, Sections 2.4 through 2.9 summarize the final effluent limitations and pretreatment standards, and Sections 2.10 through 2.13 discuss several of the implementation issues associated with this rule.

2.2 Subcategorization

For the final rule, EPA decided that a single set of limitations and standards was not appropriate for the landfills industry and, thus, developed different limitations and standards for subcategories within the industry. These subcategories are summarized below:

RCRA Subtitle C Hazardous Waste Landfill Subcategory

Subpart A of 40 CFR Part 445, "RCRA Subtitle C Hazardous Waste Landfill Subcategory," applies to wastewater discharges from a solid waste disposal facility subject to the criteria in 40 CFR Part 264 Subpart N - Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities and 40 CFR Part 265 Subpart N -Interim Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities. Hazardous waste landfills are subject to requirements outlined in 40 CFR Parts 264 and 265 that include the requirement to maintain a leachate collection and removal systems during the active life and post-closure period of the landfill. For a discussion of these criteria, see the Preamble to the proposed landfill guideline at 63 FR 6426, 6430-31. (February 6, 1998).

RCRA Subtitle D Non-Hazardous Waste Landfill Subcategory

Subpart B of 40 CFR Part 445, "RCRA Subtitle D Non-Hazardous Waste Landfill Subcategory," applies

to wastewater discharges from all landfills classified as RCRA Subtitle D non-hazardous landfills subject to either of the criteria established in 40 CFR Parts 257 (Criteria for Classification of Solid Waste Disposal Facilities and Practices) or 258 (Criteria for Municipal Solid Waste Landfills). For a discussion of these criteria, see the Preamble to the proposed landfill guideline at 63 FR 6426, 6431-32. (February 6, 1998).

2.3 Scope of Final Regulation

The final limitations and standards cover pollutants in wastewater discharges associated only with the operation and maintenance of those landfills regulated under Subtitles C and D of the Resource Conservation and Recovery Act (RCRA).[1] The rule applies to wastewater generated at both active as well as closed landfills regulated under Subtitle C or Subtitle D of RCRA.

Furthermore, this rule does not apply to wastewater discharges associated with the operation and maintenance of land application or treatment units, surface impoundments, underground injection wells, waste piles, salt dome or bed formations, underground mines, caves or corrective action units.[2] Additionally, this guideline does not apply to waste transfer stations, or any wastewater not directly attributed to the operation and maintenance of Subtitle C or Subtitle D landfill units. Consequently, wastewater, such as that generated in off-site washing of vehicles used in landfill operations, is not within the scope of this guideline.

The wastewater covered by the rule includes leachate, gas collection condensate, drained free liquids, laboratory-derived wastewater, contaminated storm water, and contact washwater from truck exteriors and surface areas which have come in direct contact with solid waste at the landfill facility. However,

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[1] EPA's Subtitle C and Subtitle D regulations define "landfill". See 40 CFR 257.2, 258.2 ("municipal solid waste landfill") and 260.10. Permitted Subtitle C landfills are authorized to accept hazardous wastes as defined in 40 CFR Part 261. Subtitle D landfills are authorized to receive municipal, commercial or industrial waste that is not hazardous (as well as hazardous waste excluded from regulation under Subtitle C).

[2] These terms are defined at 40 CFR 257.2 and 260.10.

ground water and wastewater from recovery pumping well operations which have been contaminated by a landfill and are collected and discharged are excluded from this guideline. Section 2.10 discusses the exclusion from the rule for contaminated ground water flows and for wastewater from recovering pumping wells. Discharges of non-contaminated storm water, as defined by this guideline, are also not covered by the rule. EPA defines non-contaminated storm water and discusses the rationale for not covering it in this guideline at Section 2.11.

The rule does not apply to wastewater discharges generated at a landfill that is associated with an industrial or commercial operation -- so-called "captive" landfills -- in most circumstances. The following describes the applicability of the final rule to captive landfills. The final rule does not apply to discharges of landfill wastewater from captive landfills so long as one or more of the following conditions are met:

a) The captive landfill is operated in conjunction with other industrial or commercial operations, and it only receives wastes generated by the industrial or commercial operation directly associated with the landfill.

b) The landfill is operated in conjunction with other industrial or commercial operations and it receives both wastes generated by the industrial or commercial operation directly associated with the landfill as well as other wastes and the other wastes received for landfill disposal are generated by a facility that is subject to the same provisions in 40 CFR Subchapter N as the receiving facility directly associated with the landfill.

c) The landfill is operated in conjunction with other industrial or commercial operations and it receives wastes generated by the industrial or commercial operation directly associated with the landfill as well as other wastes and the other wastes are similar in nature to the wastes generated by the industrial or commercial operation directly associated with the landfill.

d) The landfill is operated in conjunction with a Centralized Waste Treatment (CWT) facility subject to 40 CFR Part 437 so long as the CWT facility commingles the landfill wastewater with other non-landfill wastewater for treatment. If a CWT facility discharges landfill wastewater separately from other CWT wastewater or commingles the wastewater from its landfill only with wastewater from other landfills, then the landfill discharge is subject to the landfill effluent guidelines.

e) The landfill is operated in conjunction with other industrial or commercial operations, and it receives wastes from public service activities (as defined in Appendix B) and the landfill does not receive a fee or other remuneration for the disposal service.

Section 2.12 discusses in detail EPA's rationale for adopting the conditions described above for the captive landfill exclusion.

2.4 Best Practicable Control Technology Currently Available (BPT)

EPA established BPT effluent limitations guidelines for conventional, priority, and nonconventional pollutants for both subcategories. For RCRA Subtitle C hazardous waste landfills, EPA promulgated effluent limitations standards based on a treatment system consisting of equalization, chemical precipitation, biological treatment, and multimedia filtration. For RCRA Subtitle D non-hazardous waste landfills, EPA promulgated effluent limitations standards based on the following treatment: equalization, biological treatment, and multimedia filtration. Table 2-1 and Table 2-2 list the final effluent limitations and standards for the Hazardous subcategory and the Non-Hazardous subcategory, respectively.

2.5 Best Conventional Pollutant Control Technology (BCT)

EPA established BCT effluent limitations guidelines equivalent to the BPT guidelines for the control of conventional pollutants (BOD_5, TSS, and pH) for both subcategories. The effluent limitations are the same as those specified for BOD_5, TSS, and pH in Table 2-1 and Table 2-2 for the Hazardous subcategory and the Non-Hazardous subcategory, respectively

2.6 Best Available Technology Economically Achievable (BAT)

EPA established BAT effluent limitations guidelines equivalent to the BPT guidelines for control of priority and nonconventional pollutants for both subcategories. Any existing hazardous landfill subject to this guideline must achieve the following effluent limitations which represent the application of BAT: Limitations

for ammonia (as N), alpha terpineol, aniline, benzoic acid, naphthalene, p-cresol, phenol, pyridine, arsenic, chromium and zinc are the same as the corresponding limitations specified in Table 2-1.

Any existing non-hazardous landfill subject to this guideline must achieve the following effluent limitations which represent the application of BAT: Limitations for ammonia (as N), alpha terpinol, benzoic acid, *p*-cresol, phenol and zinc are the same as the corresponding limitations specified in Table 2-2.

2.7 New Source Performance Standards (NSPS)

EPA established NSPS effluent limitations guidelines equivalent to the BPT, BCT, and BAT guidelines for the control of conventional, priority and nonconventional pollutants for both subcategories. Table 2-1 and Table 2-2 list the final effluent limitations and standards for the Hazardous subcategory and the Non-Hazardous subcategory, respectively.

2.8 Pretreatment Standards for Existing Sources (PSES)

EPA did not establish PSES for either subcategory. Any source subject to this rule that introduces wastewater pollutants into a publicly owned treatment works (POTW) must comply with 40 CFR Part 403.

2.9 Pretreatment Standards for New Sources (PSNS)

EPA did not establish PSNS for either subcategory. Any new source subject to this rule that introduces wastewater pollutants into a POTW must comply with 40 CFR Part 403.

2.10 Implementation of the Rule for Contaminated Ground Water Flows and Wastewater from Recovering Pumping Wells

During development of the rule, EPA considered whether it should also include contaminated ground water flows within the scope of this guideline. Historically, many landfill operations have caused the contamination

of local ground water, mostly as a result of leakage from unlined landfill units in operation prior to the minimum technology standards for landfills established by RCRA Subtitle C and D regulations. Subsequently, State and Federal action under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) has required facilities to clean up contaminated ground water. In many cases, this has resulted in the collection, treatment, and discharge of treated ground water to surface waters. In addition, in the case of RCRA Subtitle C hazardous waste landfills and municipal solid waste landfills (MSWLFs), applicable regulatory standards require ground water monitoring and post-closure care and, in the event of ground water contamination, corrective action measures. These requirements may also result in treatment of contaminated ground water by such landfill facilities.

EPA, however, has not included contaminated ground water flows within its assessment for this guideline. Several reasons support EPA's decision not to include contaminated ground water as a regulated waste stream for this rule.

EPA evaluated flows, pollutant concentrations, treatment in place, and current treatment standards for discharges of contaminated ground water from landfills. From this evaluation, EPA concluded that pollutants in contaminated ground water flows are often very dilute or are treated to very low levels prior to discharge. EPA concluded that, whether as a result of corrective action measures taken pursuant to RCRA authority or State action to clean up contaminated landfill sites, landfill discharges of treated contaminated ground water are being adequately controlled. Consequently, further regulation under this rule would be redundant and unnecessary.

EPA is aware that there are landfill facilities that collect and treat both landfill leachate and contaminated ground water flows. In the case of such facilities, EPA has concluded that decisions regarding the appropriate discharge limits should be left to the judgment of the permit writer. As indicated by data collected through the questionnaires and EPA sampling, ground water characteristics are often site specific and may contain very few contaminants or may, conversely, exhibit characteristics similar in nature to

leachate. In cases where the ground water is very dilute, the Agency is concerned that contaminated ground water may be used as a dilution flow. In these cases, the permit writer should develop "best professional judgment" (BPJ) permit limits based on separate treatment of the flows, or develop BPJ limits based on a flow-weighted building block approach, in order to prevent dilution of the regulated leachate flows. However, in cases where the ground water may exhibit characteristics similar to leachate, commingled treatment may be appropriate, cost effective, and environmentally beneficial. EPA recommends that the permit writer consider the characteristics of the contaminated ground water before making a determination if commingling ground water and leachate for treatment is appropriate. EPA recommends that the permit writer refer to the leachate characteristics data in Chapter 6 in order to determine whether contaminated ground water at a landfill has characteristics similar to leachate.

Recovering pumping well wastewater is generated as a result of the various ancillary operations associated with ground water pumping operations. These operations include construction and development, well maintenance, and well sampling (i.e. purge water). The wastewater will have very similar characteristics to contaminated ground water. Therefore, for the same reasons that EPA did not include contaminated ground water as a regulated wastewater, these regulations do not apply to wastewater from recovering pumping well operations.

2.11 Implementation of the Rule for Storm Water Discharges

EPA received extensive comments on its proposal to include contaminated storm water as a regulated waste stream under the landfills effluent guidelines. Several commenters stated that contaminated storm water (storm water that comes into contact with solid waste at the landfill site) should not be subject to the landfills effluent limitations guidelines because this is already covered by the Final National Pollutant Discharge Elimination System Storm Water Multi-sector General Permit (MSGP) for Industrial Activities (September 29, 1995; 60 FR 50803), in States where it applies, or by an equivalent general permit issued by an NPDES authorized State.

In an effort to clarify the types of storm water runoff that are subject to the landfills effluent guidelines, EPA revised the definition of contaminated and non-contaminated storm water in the final rule. EPA defines these terms as follows:

> *Contaminated storm water*: Storm water which comes in direct contact with landfill wastes, the waste handling and treatment areas, or wastewater that is subject to the limitations and standards.
>
> *Non-contaminated storm water*: Storm water which does not come in direct contact with landfill wastes, the waste handling and treatment areas, or wastewater that is subject to the limitations and standards. Non-contaminated storm water includes storm water which flows off the cap, cover, intermediate cover, daily cover, and/or final cover of the landfill.

The Storm Water Pollution Prevention Plan (SWPPP) required by the storm water MSGP or an authorized State's equivalent general permit requires landfill facilities to identify all of the sources of storm water contamination at the landfill and then implement measures and controls (such as good housekeeping for materials storage, sediment and erosion controls - particularly from intermediate and final covers) in an effort to prevent storm water contamination. EPA believes that the storm water MSGP (or an authorized State's equivalent general permit) adequately controls pollutants from storm water runoff from covered areas of the landfill. Covered areas of the landfill include the following: capped, final cover, intermediate cover, and daily cover areas. The Agency believes that the SWPPP and the monitoring requirements in the storm water MSGP provide adequate controls for reducing the level of pollutants in storm water from these areas of landfills.

EPA recognizes that there may be some incidental contact with wastes when storm water flows over a daily or intermediate cover. However, EPA concluded that such contact will not lead to any meaningful "contamination" of the storm water so long as the landfill complies with the requirements of the storm water MSGP or an authorized State's equivalent general permit. For example, the Best Management Practices (BMPs) outlined in Table L-1 and L-2 of the storm water MSGP (60 FR 50940) and the monitoring requirements in Table L-5 and L-6 for TSS and total recoverable iron (60 FR 50943) provide adequate

controls for the pollutants that would most likely be associated with runoff from covered areas of non-hazardous landfills.

Similarly, for hazardous landfills, BMPs and monitoring requirements outlined in Table K-2 (60 FR 50935) and Table K-3 (60 FR 50936), respectively, also require controls for pollutants associated with runoff from covered areas of a landfill. In EPA's view, BMPs provide a fair degree of control of these pollutants and the monitoring requirements of the MSGP provide a tool for evaluating the effectiveness of the Storm Water Pollution Prevention Plan.

As part of the Agency's continuing effort to improve its environmental and pollution control programs, EPA has concluded that, although the MSGP provides some control for contaminated storm water runoff, the landfills effluent limitations guidelines provide a more comprehensive level of control for storm water runoff that has come in direct contact with solid waste, waste handling and treatment areas, or wastewater flows that are controlled under this rule. Although the storm water MSGP considered circumstances in which untreated leachate may be incidently commingled with storm water, the Agency explicitly acknowledged in the MSGP that insufficient data were available to establish numeric limits for storm water that might be contaminated based on best available technology for MSWLFs (60 FR 50942), non-hazardous industrial landfills (60 FR 50943), and hazardous landfills (60 FR 50935).

However, EPA has now concluded that the data collected in support of the landfills effluent limitations guidelines provide the basis for establishing appropriate numeric limitations for contaminated storm water. EPA specifically noted in the Preamble for the storm water MSGP that it was developing these guidelines and that where the guidelines applied to discharges, facilities must comply with them (60 FR 50942). In addition, EPA intends to propose a reissuance of the storm water MSGP which would include the promulgated landfills effluent limitations for contaminated storm water (as defined by this landfill guideline).

2.12 Exclusion for Captive Landfill Facilities

As discussed in Section 2.3 above, the rule does not apply to captive landfills in most circumstances. In developing the proposed guidelines, an important question EPA addressed was how to treat landfill leachate generated at a landfill that is associated with an industrial or commercial operation -- so-called "captive" landfills. Currently, in the case of wastewater sources that are not subject to effluent limitations guidelines and standards, NPDES permit writers must impose limitations on discharges of these wastewater sources that are developed on a case-by-case, best professional judgment (BPJ) basis. Similarly, an indirect discharger may not introduce any pollutants to a POTW from these sources that will pass through or interfere with the POTW's operations. Generally, each POTW is required to develop a pretreatment program and enforce the prohibition on pass through and interference through specific local limits.

EPA initially considered development of effluent guidelines to address any landfill discharging directly to surface waters of the United States or introducing pollutants into a POTW. Consequently, EPA's technical evaluation for the proposal included an assessment of virtually all landfill facilities which collect wastewater as a result of landfilling operations. EPA proposed to exclude wastewater discharges from captive landfills located at industrial facilities in specific circumstances. In the proposal, a captive landfill would not have been subject to the guidelines if: 1) it commingled landfill process wastewater with non-landfill process wastewater for treatment, and 2) the landfill received only waste generated on site or waste generated from a similar activity at another facility under the same corporate structure.

For the final rule, EPA determined that these requirements are too restrictive and therefore the Agency has decided not to include captive landfills within the scope of this guideline except in a limited number of circumstances. The effect of this decision for the final rule is not to allow these wastewater sources to escape treatment. Landfill wastewater at captive facilities is and will remain subject to treatment and controls on its discharge. The Clean Water Act (CWA) requires wastewater discharges to meet technology-based effluent limitations on the discharge whether the mechanism for imposing these limitations

is EPA-established national effluent limitations guidelines or a permit writer's imposition on a case-by-case basis of BPJ limitations. In like manner, in order to prevent pass through or interference, indirect dischargers must limit their introduction of pollutants to a POTW whether EPA has established national categorical pretreatment standards for the discharge or a POTW has established local limits.

For the final rule, EPA has modified the proposal to remove the requirement that a facility must commingle its wastewater from a captive landfill with the facility's non-landfill process wastewater for treatment in order not to be subject to the landfills effluent guideline, in most circumstances. For the reasons described in detail below, EPA did not remove the commingling requirement for CWTs. In addition, EPA also changed the conditions under which captive landfills may accept off-site wastes and not be subject to this guideline.

In the proposal, EPA stated that the commingling requirement ensures that wastewater from captive landfills will undergo adequate treatment (treatment that is comparable to the level of treatment that would be required by the landfills effluent guideline) prior to discharge. EPA determined that the commingling of landfill wastewater with industrial wastewater for treatment was an unnecessary requirement to impose in nationally applicable regulations for the reasons discussed below. Permit writers are establishing appropriate limits on these discharges by either applying the effluent limitations guidelines applicable to the associated industrial activity to the discharge or developing other BPJ limitations. EPA recommends that permit writers use this guideline when developing these BPJ limitations.

From the information developed by the Agency for this rulemaking and confirmed by comments on the proposal, EPA has concluded that landfill wastewater generated by captive landfills operated in conjunction with and receiving the bulk of their waste from an industrial or commercial operation will have a similar pollutant profile to the wastewater generated in the industrial or commercial operation. EPA has further concluded that the wastewater generated by landfill operations at most of the captive facilities are already subject to effluent guidelines. In the circumstances in which the wastewater is not expressly subject to effluent guidelines, EPA has determined that permit writers generally impose BPJ limitations on the

discharge of landfill wastewater that are similar to the limitations applicable to the discharge of industrial process wastewater whether commingled or not. EPA has compared the wastewater treatment technologies employed at many of the industrial facilities operating landfills in conjunction with industrial or commercial operations to the treatment technologies that EPA used as the basis for the BPT/BAT limits in this effluent guideline. The Agency's review of such situations shows that the landfill wastewater receives treatment that is comparable or better than the level of treatment that would be required by the landfills effluent guideline.

Consequently, EPA has decided to eliminate the requirement of commingling as a condition for a captive landfill not to be subject to landfill limitations and standards (except in the case of CWTs). EPA has concluded that landfill wastewater at captive landfills is now and will continue to receive adequate treatment because the landfill wastewater generally must meet the same effluent limitations that would have been required had the waste streams been commingled. In cases where the permit writer is establishing BPJ limitations for the discharge of captive landfill wastewater that is not commingled for treatment, the permit writer should look at the effluent guidelines applicable to the associated industrial operation and the landfills effluent guidelines for potential guidance in setting those limitations.

Because of the nature of most CWTs, EPA determined that the reasons that generally supported exclusion of other captive landfills would not apply in the case of CWTs. As explained above, EPA concluded that a captive landfill which only received wastes generated in an industrial or commercial operation directly associated with the landfill or similar wastes would generate a leachate with a similar pollutant profile to the other wastewater streams produced at the industrial operation. In such circumstances, the data reviewed by EPA showed that the landfill wastewater and other industrial wastewater are generally commingled for treatment and subject to the same discharge limitations. In these circumstances, it was appropriate not to subject the landfill to this guideline.

Because a CWT, by its very nature, may generate a wide array of different solid wastes for landfill disposal, it may generate a leachate that varies significantly from other streams being treated at the CWT at the time the leachate is collected. Therefore, EPA concluded that the basis for the exclusion -- the similarity in wastewater -- would not necessarily apply in the case of CWTs. EPA decided that, in order to ensure that the CWT landfill wastewater is treated adequately, the landfill wastewater from a CWT landfill should be commingled with other CWT wastewater for treatment.

It is worth noting that the majority of industrial facilities that operate captive landfills do commingle their landfill process wastewater with other industrial wastewater for treatment. (February 6, 1998; 63 FR 6430). A review by EPA of individual NPDES permits for captive and intracompany facilities found that, for the most part, landfill waste streams are mixed with categorical wastes and subject to limitations comparable to the final limitations for landfills.

Most captive landfill facilities choose to commingle their landfill process wastewater for treatment for several reasons. First of all, wastewater flows from captive landfills are usually quite small in comparison to the wastewater flows from other industrial operations at the captive facility. EPA's data show that the landfill wastewater flows are often less than one percent and typically less than three percent of the industrial wastewater flows. Therefore, most facilities choose to commingle the relatively small volume of landfill wastewater with the larger industrial wastewater volumes rather than maintaining and operating a completely separate wastewater treatment system for the landfill wastewater. Second, as mentioned above, it is likely that leachate from landfills at industrial operations will reflect a pollutant profile similar to the facility's industrial process wastewater. Therefore, based on the similarity of the waste streams, facilities often choose to commingle these streams for treatment. In fact, most of the captive facilities identified in EPA's database commingle their leachate with other industrial process wastewater for treatment. Comments submitted in response to the proposed rule suggest that situations do exist where a captive landfill may not commingle the landfill wastewater with other process wastewater for treatment. In circumstances where a facility chooses not to commingle landfill leachate for treatment with the other

process wastewater generated, EPA has concluded, based on comments submitted, that this wastewater will still be subject to categorical or Best Professional Judgment (BPJ) limits reflecting comparable removals in most instances.

Lastly, industrial facilities with captive landfills often choose to commingle their waste streams for treatment in order to avoid additional NPDES or pretreatment requirements that would be necessary if the waste streams were treated and discharged separately. EPA concluded that the wastewater generated by landfill operations at most of the captive facilities are already subject to categorical effluent limitations (or pretreatment standards). Information gathered by EPA prior to proposal and in comments received on the proposed rule support the conclusion that these wastewater flows were either assessed and evaluated for the effluent limitations guideline applicable to the facility, or are subject to a "building block approach" (for directs) or the "combined waste stream formula" (for indirects) for developing BPJ limits or standards established by the permit writer or local control authority. This review indicates that, for the most part, these landfill waste streams are mixed with categorical wastes for treatment and subject to limitations comparable to the final landfill regulation.

Based on comments received, the Agency also determined that the requirement in the proposal that solid wastes deposited in the captive landfill must either be generated on site or from an off-site facility under the same corporate structure was too restrictive and could often prohibit a company from safely and properly disposing of solid wastes accepted from tolling, remediation, product stewardship, and public service activities.

In the proposal, EPA narrowly limited the universe of captive landfills that fall outside the scope of this rule to captive landfills that only accepted wastes from on site or from off-site facilities under the same corporate structure. The reason for this was essentially to ensure that the captive landfills were only accepting wastes that would be similar to those wastes generated on site. This in turn would provide some degree of assurance that the leachate generated from these wastes would be compatible with the on-site industrial

wastewater treatment. However, from the comments submitted on this issue, EPA determined this waste acceptance criterion for the captive exclusion was too restrictive. Those commenting on this issue identified several waste acceptance practices that are commonly used by captive landfills that would not meet the proposed exclusion criteria but are consistent with EPA's objective that landfill leachate receive treatment compatible with its expected constituents. Many of these current waste disposal practices are activities that EPA encourages and, therefore, EPA has revised the exclusion criteria pertaining to waste acceptance for captive/intracompany landfills in order to accommodate these disposal practices.

Specifically, several commenters requested that EPA broaden the criteria for determining those captive landfills that fall outside the scope of this rule to include waste acceptance from tolling and contract manufacturers, product stewardship, company partnerships, and remediation activities. EPA concluded that waste disposal at captive landfills from these types of activities will, in most cases, result in leachate that will be adequately controlled through the implementation of categorical or BPJ limitations at the facility. However, EPA remains concerned that there are circumstances in which inter-company waste products deposited in the landfill may result in contaminants in the leachate that may not be compatible with the existing industrial wastewater treatment system or may not be covered adequately by the existing industrial effluent guideline. Therefore, one of the alternative conditions for the revised applicability provisions of the guideline described above for captive landfills provides that waste accepted at the captive landfill must be of a similar nature to the wastes generated at the operation with the associated landfill. Thus, the permitting authority must determine that wastes accepted for disposal at a captive landfill are of a similar nature to the waste generated at the facility directly associated with the captive landfill. Factors that the permit writer should consider in determining whether a waste is similar are described at Section 2.13.

In addition, commenters also requested that EPA include the acceptance of wastes for disposal as a public service as a category of landfill practices that qualify for the captive exclusion. EPA agrees and has included such a provision. EPA applauds the efforts of manufacturing facilities who provide members of their communities with a cost effective and environmentally safe means for disposing of their solid waste.

Therefore, in the final rule, EPA determined that this rule shall not apply to those landfills operated in conjunction with other industrial or commercial operations which receive other wastes from public service activities so long as the company owning the landfill does not receive a fee or other remuneration for the disposal service. EPA's decision not to subject captive landfills that accept off-site wastes for disposal as a public service is not inconsistent with its decision generally to condition non-applicability on the similarity of wastes accepted for disposal. Based on its review of data collected for this guideline and comments received, EPA concluded that the quantity of wastes accepted for disposal as a public service would not in any measurable way affect the pollutant profile of the leachate generated by the landfill even if dissimilar. Of course, these wastewater flows still remain subject to treatment to achieve BPJ permit limits reflecting the landfill contribution to the facility discharge.

The Agency has determined that whether captive landfills accepting wastes from off site or from a company not within the same corporate structure on a non-commercial basis should be subject to the landfills effluent guideline should hinge on the ability of the captive landfill to handle the waste in an appropriate manner. Therefore, the Agency concluded that the waste acceptance criterion for determining those captive landfills that fall outside the scope of this rule should be based on the similarity of the waste accepted for disposal from another facility to the waste generated by the industrial or commercial operation directly associated with the landfill. In the case of captive landfills treating similar wastes, the permit writer should base permit limits on limitations for the guideline to which the industrial or commercial operation is subject or establish BPJ limitations. Again, the permit writer, if developing BPJ limitations, should consider these landfill guidelines as guidance in this effort.

2.13 Determination of Similar Wastes for Captive Landfill Facilities

As discussed at Sections 2.3 and 2.12 above, the Agency concluded that discharges from captive landfills should not be subject to the guidelines if the captive landfills only accepted waste for disposal from another facility that was similar to the waste generated by the industrial or commercial operation directly associated with the landfill. This section offers guidance to permit writers for determining whether a solid waste

received for disposal in a captive landfill is similar to those wastes generated by the facility directly associated with the landfill.

According to EPA's database, many of the industrial or commercial facilities that operate captive landfills are subject to effluent limitations guidelines in 40 CFR Subchapter N. For the most part, facilities subject to a particular industrial category effluent guideline produce similar types of wastes. Therefore, EPA decided that this rule does not apply to landfills operated in conjunction with other industrial or commercial operations when the landfill receives wastes generated by the industrial or commercial operation directly associated with the landfill and also receives other wastes generated by a facility that is subject to the same provisions in 40 CFR Subchapter N as the waste-receiving facility. However, there are cases where a captive landfill is directly associated with an industrial or commercial operation that is not subject to an effluent guideline. Or, a facility, subject to an effluent guideline, may operate a landfill in conjunction with industrial or commercial operations, but may also accept other wastes from facilities that are not subject to the same effluent guideline or not subject to an effluent guideline at all. In these cases, the permit writer must determine whether the other wastes received for disposal are of similar nature to the wastes generated by the industrial or commercial operation directly associated with the landfill. In cases where the permit writer determines that the other waste accepted by the captive landfill is not similar to the waste generated by the industrial or commercial activity directly associated with the landfill, the landfill wastewater will be subject to the landfills effluent limitations. However, if the permit writer determines that the wastes are similar, then the wastewater from the captive landfill should be subject to the same categorical effluent guideline (or BPJ limitations) as the industrial or commercial facility.

A permit writer should consider the following factors in deciding whether other wastes received by a captive landfill are similar to those wastes generated by the industrial or commercial operation directly associated with the landfill:

1. Are the other wastes received from facilities that are subject to the same provisions in 40 CFR Subchapter N as the facility directly associated with the captive landfill?

If so, then the landfills effluent guidelines do not apply to this captive landfill. If not, then the permit writer should consider the other factors listed below.

2. Are the other wastes received from facilities that are part of the same effluent guidelines "grouping" as shown in Table 2-3?

   If so, it is likely that the wastes are similar and the landfills effluent guidelines do not apply. Table 2-3 groups the industrial categories under Subchapter N into the following six groups: Organics, Metals, Inorganics and Non-Metals, Pesticides, Explosives, and Asbestos. It is likely that industries within the same industrial effluent guideline "grouping" will generate similar types of constituents in the solid wastes, and the leachate resulting from the disposal of these wastes will be controlled adequately by the effluent limitation for the industrial or commercial facility directly associated with the captive landfill. However, this may not always be the case and, therefore, EPA left to the local control authority the determination of whether the landfills effluent guideline should apply to a captive landfill that accepts wastes from other facilities that are not subject to the same provisions in 40 CFR Subchapter N. The local permitting authority will determine whether a captive landfill which accepts wastes from other industrial activities, apart from those directly associated with the landfill, is subject to the landfills effluent guidelines based on the similarity of the other wastes and the likelihood that these wastes will result in leachate that is compatible with the wastewater treatment technology used to treat the landfill leachate.

3. In the case of hazardous captive landfills, do the other wastes being received have the same hazardous waste codes as those generated at the facility directly associated with the landfill?

   If so, it is possible that the wastes are similar. However, this may not always be the case and, therefore, EPA left to the local control authority the determination of whether the landfills effluent guideline should apply to a captive landfill that accepts wastes from other facilities that are not subject to the same provisions in 40 CFR Subchapter N.

4. Is a significant portion of the waste deposited in the landfill from the industrial or commercial operation that is directly associated with the captive landfill?

   The control authority should analyze the number of customers and the amount of the off-site or inter-company waste deposited relative to the quantity of on-site or intracompany waste placed in the captive landfill. Again, the main reason for the exclusion for captive landfills is that their leachate should resemble the industrial wastewater of the operation directly associated with the landfill and, therefore, the landfill leachate will be adequately controlled by the applicable industrial effluent guidelines. However, this logic is only applicable when the bulk of the waste placed in the landfill is of similar content to that being produced by the industrial facility directly associated with the landfill. Therefore, when

applying the captive exclusion, the control authority should analyze the volume and characteristics of waste received from inter-company waste transfers in determining whether the leachate generated by the captive landfill will have similar characteristics to the industrial wastewater generated by the company owning the landfill.

5. Is the facility that is directly associated with the captive landfill deriving any revenues from waste disposal at the landfill?

   In developing the exclusion for captive landfills, EPA's intent was to exclude those non-commercial landfills that are directly associated with an industrial or commercial operation and whose leachate is currently being adequately addressed by the facility's categorical or BPJ limitations. EPA believes that where any revenues are being derived from the collection of fees for solid waste disposal at a captive landfill, the facility is accepting wastes on a commercial basis - - wastes that may well be dissimilar to that being disposed of at the landfill. The captive exception is premised on the fact that, in most cases, leachate from a landfill associated with an industrial operation will resemble the industrial process wastewater generated by the industrial operation and, therefore, the landfill leachate will be adequately controlled by the applicable industrial effluent guidelines or BPJ limitations. However, this is a reasonable assumption only in circumstances where the waste placed in the landfill is of similar content to that being produced by the industrial operation directly associated with the landfill. It is likely that a commercial landfill may accept significant volumes of waste that are not similar to the wastes generated by the industrial operation directly associated with the landfill.

6. Is the industrial or commercial facility directly associated with the captive landfill accepting wastes for disposal as part of public service activities?

   If so, and the facility does not receive a fee or other remuneration for the disposal service, the captive landfill is not subject to this rule. EPA defines public service activities in Appendix B.

Table 2-1: Final Concentration Limitations for Hazardous Landfill Subcategory, Direct Discharges

Pollutant or Pollutant Property	Maximum for 1 day (mg/L)	Monthly average shall not exceed (mg/L)
BOD_5	220	56
TSS	88	27
Ammonia	10	4.9
Arsenic (Total)	1.1	0.54
Chromium (Total)	1.1	0.46
Zinc (Total)	0.535	0.296
Alpha Terpineol	0.042	0.019
Aniline	0.024	0.015
Benzoic Acid	0.119	0.073
Naphthalene	0.059	0.022
p-Cresol	0.024	0.015
Phenol	0.048	0.029
Pyridine	0.072	0.025
pH	Shall be in the range 6.0 - 9.0 pH units.	

Table 2-2: Final Concentration Limitations for Non-Hazardous Landfill Subcategory, Direct Discharges

Pollutant or Pollutant Property	Maximum for 1 day (mg/L)	Monthly average shall not exceed (mg/L)
BOD_5	140	37
TSS	88	27
Ammonia	10	4.9
Zinc	0.20	0.11
Alpha Terpineol	0.033	0.016
Benzoic Acid	0.12	0.071
p-Cresol	0.025	0.014
Phenol	0.026	0.015
pH	Shall be in the range 6.0 - 9.0 pH units.	

Table 2-3: Grouping of Subchapter N Effluent Guidelines and Standards

Industrial Category	Part #	Characteristics					
		Organics	Metals	Inorganics Non-metal	Pesticides	Explosives	Asbestos
Dairy products and processing	405	X					
Grain mills	406	X					
Canned and preserves fruits and vegetables	407	X					
Canned and preserved seafood	408	X					
Sugar processing	409	X					
Textile mills	410	X	X				
Cement manufacturing	411		X	X			
Feedlots	412	X					
Electroplating	413		X				
Organic chemicals, plastics and synthetic fibers	414	X					
Inorganic chemicals manufacturing	415			X			
Soap and detergent manufacturing	417	X					
Fertilizer manufacturing	418			X			
Petroleum refining	419	X					
Iron and steel manufacturing	420		X				
Nonferrous metals manufacturing	421		X				
Phosphate manufacturing	422			X			
Steam electric power plants	423	X	X				
Ferroalloy manufacturing	424		X				
Leather tanning and finishing	425	X	X				
Glass manufacturing	426			X			
Asbestos manufacturing	427						X
Rubber processing	428	X					
Timber products processing	429	X					
Pulp, paper and paperboard	430	X					
Builder's paper and board mills	431	X					
Meat products	432	X					
Metal finishing	433		X				
Coal mining	434			X			
Oil and gas extraction	435	X					
Mineral mining and processing	436		X				
Pharmaceutical preparations	439	X					
Ore mining	440		X				
Paving and roofing materials (tars & asphalt)	443	X		X			
Paint formulation	446	X	X				
Ink formulation	447	X					
Gum and wood chemicals	454	X	X				
Pesticides	455				X		
Explosives manufacturing	457					X	
Carbon black manufacturing	458	X					
Photographic equipment and supplies	459		X				
Hospital	460	X					

3.0 INDUSTRY DESCRIPTION

The Landfills industry consists of facilities that receive wastes either as commercial or municipal operations or as on-site (captive) operations owned by waste generators. These landfill facilities generate wastewater and discharge it to surface waters, publicly owned treatment works (POTWs), or use some other form of zero or alternative disposal. The Resource Conservation and Recovery Act (RCRA) defines a landfill as "an area of land or an excavation in which wastes are placed for permanent disposal, and that is not a land application unit, surface impoundment, injection well, or waste pile" (40 CFR 257.2). RCRA classifies landfills as either Subtitle C hazardous or Subtitle D non-hazardous. Wastewater generated and discharged by landfills can include, but is not limited to, leachate, gas collection condensate, contaminated ground water, contaminated storm water, drained free liquids, truck/equipment washwater, laboratory-derived wastewater, and wastewater recovered from pumping wells.

Landfills are commonly classified by the types of wastes they accept and/or by their ownership status. Some of the terms used to describe a landfill include municipal, sanitary, chemical, industrial, RCRA, hazardous waste, Subtitle C, and Subtitle D. Although non-hazardous landfills do not knowingly accept hazardous wastes, these facilities may contain hazardous wastes due to disposal practices that occurred prior to 1980 and before the enactment of RCRA and its associated regulations. The following section provides descriptions of landfills in terms of ownership type and regulatory type.

Ownership Status

- ***Municipal:*** Municipally-owned landfills are those that are owned by local governments. Municipally-owned landfills may be designed to accept either Subtitle D or Subtitle C wastes (see "Regulatory Type").

- ***Commercial:*** Commercial landfills are privately-owned facilities and can be designed to receive either municipal, hazardous, or non-hazardous industrial wastes. Typical non-hazardous industrial wastes include packaging and shipping materials, construction and demolition debris, ash, and sludge.

- ***Captive:*** Captive landfills are operated in conjunction with other industrial or commercial operations, and receive the bulk of their wastes from the industrial or commercial operations. Captive landfills are located on, or adjacent to, the facility they service and are common at major hazardous waste generators, such as chemical and petrochemical manufacturing plants.

- ***Intra-company:*** Landfill facilities operated in conjunction with other industrial or commercial operations which only receive waste from off-site facilities under the same corporate structure, ownership, or control. These landfills are similar to captive sites but receive wastes from multiple locations of one company.

Regulatory Type

- ***Subtitle C:*** Subtitle C landfills are those disposal operations authorized by RCRA to accept hazardous wastes as defined in 40 CFR Part 261. Subtitle C landfills are subject to the criteria in 40 CFR Part 264 Subpart N - Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities and 40 CFR Part 265 Subpart N - Interim Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities. Hazardous waste landfills are subject to requirements outlined in 40 CFR Parts 264 and 265 that include the requirement to maintain a leachate collection and removal systems during the active life and post-closure period of the landfill. Section 3.1 presents more details on the regulatory requirements of Subtitle C.

- ***Subtitle D:*** Subtitle D landfills are those disposal operations that are subject to either of the criteria established in 40 CFR Parts 257 (Criteria for Classification of Solid Waste Disposal Facilities and Practices) or 258 (Criteria for Municipal Solid Waste Landfills). The wastes received at Subtitle D landfills include municipal refuse, ash, sludge, construction and demolition debris, and non-hazardous industrial waste. These facilities were not designed to receive hazardous wastes; however, prior to 1980 and the enactment of RCRA, older landfills may have received waste later classified as hazardous under RCRA. Any Subtitle D landfill accepting municipal refuse after October 9, 1993 is classified as a Municipal Waste Disposal Unit, and is regulated under 40 CFR 258. Any Subtitle D landfill not accepting municipal waste after October 9, 1993 continues to be regulated under 40 CFR 257. For the purposes of this document, Subtitle D landfills not accepting municipal refuse are referred to as "Subtitle D non-municipal" landfills.

The following discussions present a regulatory history of this industry and past EPA studies.

3.1 Regulatory History of the Landfills Industry

Depending on the type of wastes disposed of at a landfill, the landfill may be subject to regulation and permitting under either Subtitle C or Subtitle D of RCRA. Subtitle C facilities receive wastes that are identified or listed as hazardous wastes at 40 CFR Part 261. Subtitle D landfills can only accept wastes that are not defined as hazardous wastes at 40 CFR Part 261. The following sections outline some of the key regulations that have been developed to control the environmental impacts of Subtitle C and Subtitle D landfills.

3.1.1 RCRA Subtitle C

Subtitle C of the RCRA of 1976 directed EPA to promulgate regulations to protect human health and the environment from the improper management of hazardous wastes. Based on this statutory mandate, the goal of the RCRA program was to provide comprehensive, "cradle-to-grave" management of hazardous waste. These regulations establish a system for tracking the disposal of hazardous wastes and special design requirements for landfills depending on whether a landfill accepted hazardous or non-hazardous waste. Key statutory provisions in RCRA Subtitle C include the following:

- Section 3001: Requires the promulgation of regulations identifying the characteristics of hazardous waste and listing particular hazardous wastes.
- Section 3002: Requires the promulgation of standards, such as manifesting, record keeping, etc., applicable to generators of hazardous waste.
- Section 3003: Requires the promulgation of standards, such as manifesting, record keeping, etc., applicable to transporters of hazardous waste.
- Section 3004: Requires the promulgation of performance standards applicable to the owners and operators of facilities for the treatment, storage, or disposal of hazardous waste.
- Section 3005: Requires the promulgation of regulations requiring each person owning or operating a treatment, storage, or disposal facility to obtain a permit.

These regulations establish a system for tracking the disposal of hazardous wastes and performance and design requirements for landfills accepting hazardous waste. Under RCRA, requirements are initially triggered by a determination that a waste is hazardous as defined in 40 CFR Part 261. Any party, including the original generator, that treats, stores, or disposes of a hazardous waste must notify EPA and obtain an EPA identification number. EPA established performance regulations governing the operation of hazardous waste landfills at 40 CFR Parts 264 and 265. RCRA Subtitle C hazardous waste regulations apply to landfills that presently accept hazardous wastes or have accepted hazardous waste at any time after November 19, 1980.

3.1.1.1 Land Disposal Restrictions

The Hazardous and Solid Waste Amendments (HSWA) to RCRA, enacted on November 8, 1984, largely prohibit the land disposal of untreated hazardous wastes. Once a hazardous waste is prohibited from land disposal, the statute provides only two options for legal land disposal: 1) meet the EPA-established treatment standard for the waste prior to land disposal, or 2) dispose of the waste in a land disposal unit that has been found to satisfy the statutory no-migration test. A no- migration unit is one from which there will be no migration of hazardous constituents for as long as the waste remains hazardous. (RCRA Sections 3004 (d),(e),(g)(5)).

Under Section 3004 of RCRA, the treatment standards that EPA develops may be expressed as either constituent concentration levels or as specific methods of treatment. Under RCRA Section 3004(m)(1), the criteria for these standards is that they must substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short-term and long-term threats to human health and the environment are minimized. For purposes of the restrictions, the RCRA program defines land disposal to include, among other things, any placement of hazardous waste in a landfill. Land disposal restrictions are published in 40 CFR Part 268.

EPA has used hazardous waste treatability data as the basis for land disposal restrictions standards. EPA has identified Best Demonstrated Available Treatment Technology (BDAT) for each listed hazardous waste. BDAT is the treatment technology that EPA finds to be the most effective in treating a waste and that also is readily available to generators and treaters. In some cases, EPA has designated as BDAT for a particular waste stream a treatment technology shown to have successfully treated a similar but more difficult to treat waste stream. This ensured that the land disposal restrictions standards for a listed waste stream were achievable since they always reflected the actual treatability of the waste itself or of a more refractory waste.

As part of the Land Disposal Restrictions (LDRs), EPA promulgated Universal Treatment Standards (UTS) as part of the RCRA phase two final rule (July 27,1994). The UTS are a series of concentrations for wastewater and non-wastewater that provide a single treatment standard for each constituent. Previously, the LDR regulated constituents according to the identity of the original waste; thus, several numerical treatment standards existed for each constituent. The UTS simplified the standards by having only one treatment standard for each constituent in any waste residue. The LDR and the UTS restricted the concentrations of wastes that could be disposed of in landfills, thus improving the environmental quality of the leachate from landfills.

The LDR treatment standards established under RCRA may differ from the Clean Water Act effluent guidelines both in their format and in the numerical values set for each constituent. The differences result from the use of different legal criteria for developing the limits and resulting differences in the technical and economic criteria and data sets used for establishing the respective limits.

The difference in format of the LDR and effluent guidelines is that LDR establishes a single daily limit for each pollutant parameter while effluent guidelines establish monthly and daily limits. Additionally, the effluent guidelines provide for several types of discharge, including new and existing sources, and indirect and direct discharge.

The differences in numerical limits established under the Clean Water Act may differ, not only from LDR and UTS, but also from point-source category to point-source category (e.g., Electroplating, 40 CFR 413; and Metal Finishing, 40 CFR 433). The effluent guidelines limitations and standards are industry-specific, subcategory-specific, and technology-based. The numerical limits are typically based on different data sets that reflect the performance of specific wastewater management and treatment practices. Differences in the limits reflect differences in the following statutory factors that the Administrator is required to consider in developing technically and economically achievable limitations and standards: manufacturing products and processes (which for landfills involves types of waste disposed), raw materials, wastewater characteristics, treatability, facility size, geographic location, age of facility and equipment, non-water quality environmental impacts, and energy requirements. A consequence of these differing approaches is that similar or identical waste streams are regulated at different levels dependent on the receiving body of the wastewater (e.g. a POTW, a surface water, or a land disposal facility).

3.1.1.2 Minimum Technology Requirements

To further protect human health and the environment from the adverse affects of hazardous waste disposed of in landfills, the 1984 HSWA to RCRA established minimum technology requirements for landfills receiving hazardous waste. These provisions required the installation of double liners and leachate collection systems at new landfills, at replacements of existing units, and at lateral expansions of existing units. The Amendments also required all hazardous waste landfills to install ground water monitoring wells by November 8, 1987. Performance regulations governing the operation of hazardous waste landfills are included at 40 CFR Parts 264 and 265.

3.1.2 RCRA Subtitle D

Landfills managing non-hazardous wastes are currently regulated under the RCRA Subtitle D program. These landfills include municipal, private intra-company, private captive, and commercial facilities used for the management of municipal refuse, incinerator ash, sewage sludge, and a range of non-hazardous industrial wastes.

3.1.2.1 40 CFR Part 257, Subpart A - Criteria for Classification of Solid Waste Disposal Facilities and Practices

EPA promulgated the criteria on September 13, 1979 (44 FR 53460) under the authority of RCRA Sections 1008(a) and 4004(a) and Sections 405(d) and (e) of the Clean Water Act. The criteria in §257.1 through 257.4 were adopted for determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health and the environment, and the criteria in §257.5 through 257.30 were adopted to ensure that non-municipal non-hazardous waste disposal units that receive conditionally exempt small quantity generator (CESQG) waste do not present risks to human health and the environment taking into account the practicable capability of such units. These criteria apply to all solid waste disposal facilities and practices. However, certain facilities and practices are not covered by the criteria, such as agricultural wastes returned to the soil as fertilizers or soil conditioners, overburden resulting from mining operations intended for return to the mine site, land application of domestic sewage or treated domestic sewage, the location and operation of septic tanks, hazardous waste disposal facilities which are subject to regulations under RCRA Subtitle C (discussed above), municipal solid waste landfills that are subject to the revised criteria in 40 CFR Part 258 (discussed below), and use or disposal of sewage sludge on the land when the sewage sludge is used or disposed of in accordance with 40 CFR Part 503 (See 40 CFR Part 257.1(c)(1) - (11)).

The criteria include general environmental performance standards addressing the following eight major areas: flood plains, protection of endangered species, protection of surface water, protection of ground water, limitations on the land application of solid waste, periodic application of cover to prevent disease vectors, air quality standards (prohibition against open burning), and safety practices ensuring protection from explosive gases, fires, and bird hazards to airports. Facilities that fail to comply with any of these criteria are considered open dumps, which are prohibited by RCRA Section 4005. Those facilities that meet the criteria are considered sanitary landfills under RCRA Section 4004(a). Landfill wastewater generated at solid waste disposal facilities that are subject to the requirements of 40 CFR Part 257 Subpart A are subject to the effluent limitations for the Non-Hazardous subcategory.

3.1.2.2 40 CFR Part 257, Subpart B - Conditionally Exempt Small Quantity Generator Revised Criteria

A conditionally-exempt small-quantity generator is generally defined as one who generates no more than 100 kilograms of hazardous waste per month in a calendar year (40 CFR 261.5(a)). Such conditionally-exempt small-quantity generators (with certain exceptions) are not subject to RCRA Subtitle C requirements. However, on July 1, 1996, EPA did the following: (1) amended Part 257 to establish criteria that must be met by non-municipal, non-hazardous solid waste disposal units that receive conditionally-exempt small-quantity generator waste and (2) established separate management and disposal standards (in 40 CFR 261.5(f)(3) and (g)(3)) for those who generate conditionally-exempt small-quantity generator waste (see 61 FR 342169). The conditionally-exempt small-quantity generator revised criteria for such disposal units include location standards, ground water monitoring, and corrective action requirements. Landfill wastewater generated at solid waste disposal facilities that are subject to the requirements of 40 CFR Part 257 Subpart B are subject to the effluent limitations for the Non-Hazardous subcategory.

3.1.2.3 40 CFR Part 258 Revised Criteria for Municipal Solid Waste Landfills

On October 9, 1991, EPA promulgated revised criteria for municipal solid waste landfills in accordance with the authority provided in RCRA Sections 1008(a)(3), 4004(a), 4010 (c) and Clean Water Act (CWA) Sections 405(d) and (e) (see 56 FR 50978). Under the terms of these revised criteria, municipal solid waste landfills are defined to mean a discrete area of land or an excavation that receives household waste, and is not a land application unit, surface impoundment, injection well, or waste pile, as those terms are defined in 40 CFR 257.2 and 258.2. In addition to household waste, a municipal solid waste landfill unit also may receive other types of RCRA Subtitle D wastes, such as commercial solid waste, non-hazardous sludge, and industrial solid waste. Such a landfill may be publicly or privately owned. A municipal solid waste landfill unit may be a new unit, existing municipal solid waste landfill unit, or a lateral expansion.

The municipal solid waste landfill revised criteria include location standards (Subpart B), operating criteria (Subpart C), design criteria (Subpart D), ground water monitoring and corrective action (Subpart E), closure and post-closure care criteria (Subpart F), and financial assurance requirements (Subpart G). The design criteria specify that new municipal solid waste landfill units and lateral expansions of existing units (as defined in Section 258.2) must be constructed in accordance with either (1) a design approved by a Director of a State whose municipal solid waste landfill permit program has been approved by EPA and which satisfies a performance standard to ensure that unacceptable levels of certain chemicals do not migrate beyond a specified distance from the landfill (Sections 258.40(a)(1), (c), (d), Table 1) or (2) a composite liner and a leachate collection system (Sections 258.40(a)(2), (b)). The ground water monitoring criteria generally require owners or operators of municipal solid waste landfills to monitor ground water for contaminants and generally implement a corrective action remedy when monitoring indicates that a ground water protection standard has been exceeded. However, certain small municipal solid waste landfills located in arid or remote locations are exempt from both design and ground water monitoring requirements. The closure standards require that a final cover be installed to minimize infiltration and erosion. The post-closure provisions generally require, among other things, that ground water monitoring continue and that the leachate collection system be maintained and operated for 30 years after the municipal solid waste landfill is closed. The Director of an approved State may increase or decrease the length of the post-closure period.

Again, as is the case with solid waste disposal facilities that fail to meet the requirements in 40 CFR Part 257, Subpart A, municipal solid waste landfills that fail to satisfy the revised criteria in Part 258 constitute open dumps and are therefore prohibited by RCRA Section 4005 (40 CFR 258.1(h)). Landfill wastewater generated at solid waste disposal facilities (i.e., municipal solid waste landfills) that are subject to the requirements in 40 CFR Part 258 are subject to the effluent limitations for the Non-Hazardous subcategory.

3.1.3 Current Wastewater Regulations

Prior to this regulation, EPA had not promulgated national effluent limitations guidelines for the discharge

of wastewater from the Landfills industry. In the absence of these guidelines, permit writers have had to rely on a combination of their own best professional judgement (BPJ), water quality standards, and technology transfer from other industrial guidelines in setting permit limitations for landfills discharging to surface waters. In addition, local control authorities also have had to rely on their own best professional judgement, pass-through analyses, and other local factors in establishing pretreatment standards for the discharge of landfill wastewater to their municipal sewage systems and POTWs.

In 1989, EPA completed a preliminary study of the Landfills industry. In a report entitled "Preliminary Data Summary for the Hazardous Waste Treatment Industry," EPA concluded that wastewater discharges from landfills can be a significant source of toxic pollutants being discharged to surface waters and POTWs. In a consent decree between NRDC and EPA, dated January 31, 1992, EPA agreed, among other things, to propose effluent guidelines for the "Landfills and Industrial Waste Combusters" category by November 1997 and final action by November 1999.

3.2 Industry Profile

The growth of the Landfills industry is a direct result of RCRA and subsequent EPA and State regulations that establish the conditions under which solid waste may be disposed. The implementation of the increased control measures required by RCRA has had a number of ancillary effects on the Landfills industry.

The RCRA requirements have affected the Landfills industry in different ways. On the one hand, it has forced many landfills to close because they lacked adequate on-site controls to protect against migration of hazardous constituents from the landfill, and it was not economical to upgrade the landfill facility. As a result, a large number of landfills, especially facilities serving small populations, have closed rather than incur the significant expense of upgrading.

Conversely, large landfill operations have taken advantage of economies of scale by serving wide geographic areas and accepting an increasing portion of the nation's solid waste. For example, responses

to the EPA's Waste Treatment Industry Survey indicated that 75 percent of the nation's municipal solid waste is deposited in large landfills representing only 25 percent of the landfill population.

EPA has identified several trends in the waste disposal industry that may increase the quantity of leachate produced by landfills. More stringent RCRA regulations and the restrictions on the management of wastes have increased the amount of waste disposed at landfills as well as the number of facilities choosing to send wastes off site to commercial facilities in lieu of pursuing on-site management options. This will increase treated leachate discharges from the nation's landfills, thus, potentially putting at risk the integrity of the nation's waters. Further, as a result of the increased number of leachate collection systems, the volume of leachate requiring treatment and disposal has greatly increased.

3.2.1 Industry Population

In developing the initial landfill population to be studied for this regulation, EPA used various sources such as State environmental and solid waste departments, the National Survey of Hazardous Waste Treatment, Storage, Disposal, and Recycling Facilities respondent list, Environmental Ltd.'s "1991 Directory of Industrial and Hazardous Waste Management Firms", and other sources discussed in Chapter 4. EPA identified 10,477[1] landfill facilities as the initial landfill population in the United States in 1992. Of this group, 9,882 were Subtitle D non-hazardous landfills and 595 were Subtitle C hazardous landfills. Table 3-1 presents the total number of landfill facilities by state in EPA's mailing list database. EPA solicited technical information from a sample of this initial population via screener surveys, and the Agency sent Detailed Technical Questionnaires to a statistical sample of the screener survey respondents. A total of 252 landfill facilities received Detailed Technical Questionnaires and 220 facilities responded with sufficient technical data to be included in the questionnaire database. Chapter 4, Section 4.3 presents a detailed discussion of screener survey and Detailed Questionnaire strata.

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[1] The initial landfill population of 10,477 does not include one pre-test facility which was included as a screener survey respondent.

Because EPA only sent Detailed Technical Questionnaires to a statistical sample of the initial industry population, the Agency scaled up the information provided by questionnaire respondents to represent the entire Landfills industry. By matching up the screener survey stratum with the Detailed Technical Questionnaire stratum, EPA calculated a weighting factor for each questionnaire respondent and scaled up any data provided by the respondent by this factor. Therefore, throughout this chapter, EPA presents national estimates based on the Detailed Technical Questionnaire respondents' data scaled up by their individual weighting factors. The Agency based the national estimates presented in the tables in this chapter on all 220 facilities included in the questionnaire database. Figure 3-1 presents the logic used for the development of the national estimates. EPA presents the methodology for calculating national estimates in the Final Statistical Development Document for the Landfills Industry (EPA-821-B-99-007).

3.2.2 Number and Location of Facilities

Many of the landfill facilities presented in Table 3-1 do not generate and/or collect wastewater that is subject to this regulation. Landfill generated wastewater subject to this regulation includes leachate, gas collection condensate, truck/equipment washwater, drained free liquids, laboratory-derived wastewater, floor washings, and contaminated storm water. Non-contaminated storm water, contaminated ground water, and wastewater from recovering pumping wells are not subject to this regulation.

National estimates of the Landfills industry indicate that only 1,662 of the total population of landfill facilities collect landfill generated wastewater. EPA limited its survey of the industry to those facilities that collect landfill generated wastewater, or about 16 percent of the total number of landfills located in the U.S. Table 3-2 presents the Subtitle D and Subtitle C landfills that collect landfill generated wastewater by ownership type. The national estimates for the industry indicate that approximately 43 percent of these landfills are municipally-owned facilities, 41 percent are commercially-owned, and 13 percent are non-commercial captives. Table 3-2 also shows that the majority of non-hazardous landfills are municipally- or commercially-owned facilities, whereas hazardous landfills are primarily commercially-owned or captive facilities.

3.2.2.1 Captive Landfill Facilities

Based on EPA's survey of the Landfills industry for this guideline, the Agency identified over 200 captive and intra-company facilities that operated landfills. This rule does not apply to captive landfills in most circumstances. See Chapter 2 for EPA's rationale for not including captive landfills under this guideline.

EPA's survey showed that a majority of these landfills were at industrial facilities that are or will be subject to the following three effluent guidelines: Pulp and Paper (40 CFR Part 430), Centralized Waste Treatment (proposed 40 CFR Part 437, 64 FR 2280 January 13, 1999), or Organic Chemicals, Plastics and Synthetic Fibers (40 CFR Part 414). In addition, EPA identified approximately 30 landfills subject to one or more of the following categories: Nonferrous Metals Manufacturing (40 CFR Part 421), Petroleum Refining (40 CFR 419), Timber Products Processing (40 CFR Part 429), Iron and Steel Manufacturing (40 CFR Part 420), Transportation Equipment Cleaning (proposed 40 CFR Part 442, 63 FR 34685 June 25, 1998), and Pesticide Manufacturing (40 CFR Part 455).

Industry supplied data estimates that there are over 118 Pulp and Paper facilities with on-site landfills and that over 90 percent commingle landfill leachate with process wastewater for treatment on site. The wastewater flow originating from landfills typically represents less than one percent of the total flow through the facilities' wastewater treatment plant and, in no case, exceeds three percent of the treated flow. Approximately six percent of pulp and paper mills send landfill generated wastewater to a POTW along with process wastewater.

Based on responses to the "1992 Waste Treatment Industry: Landfills Questionnaire", EPA estimates that there are more than 30 facilities subject to the Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) guideline with on-site landfills. At OCPSF facilities with on-site landfills, landfill leachate typically represents less than one percent of the industrial flow at the facility, in no case exceeds six percent of the flow, and is typically commingled with process wastewater for treatment.

3.2.3 General Information on Landfill Facilities

EPA estimates that landfill facilities located throughout the U.S. cover approximately 726,000 acres of land area, 20 percent of which is actual disposal area (landfill), 3 percent is for wastewater treatment operations, and 63 percent is undeveloped land. Table 3-3 presents national estimates of the total landfill area covered by non-hazardous and hazardous landfill facilities. National estimates indicate that, as of 1992, hazardous facilities had, on average, used less of their total facility area for waste disposal, only about 5 percent, than non-hazardous facilities, which, on average, had used approximately 30 percent of their total facility area for waste disposal. However, since there are far more non-hazardous landfills in the U.S. than hazardous landfills, Subtitle D landfills have more future capacity than Subtitle C landfills (see Section 3.2.4). Table 3-4 presents facility land area ranges for non-hazardous and hazardous facilities, as well as totals for the industry. These frequency distributions show that a typical facility is 100 to 1,000 acres in size, and the actual landfill covers between 10 and 100 acres of that area. As of 1992, the majority of non-hazardous and hazardous landfill facilities had from 10 acres to 1,000 acres of undeveloped land available; larger facilities had as much as 1,000 to 10,000 acres of undeveloped land.

Landfills are made up of individual cells which may be dedicated to one type of waste or may accept many different types of waste. When a landfill cell reaches capacity volume, it is closed and is referred to as an "inactive" cell. "Active" cells are landfill cells that are not at capacity and continue to accept waste. Table 3-5 presents national estimates of the number of landfill cells, both active and inactive, at non-hazardous and hazardous landfills. National estimates of landfill facilities in the U.S. indicate that the average number of cells in a landfill in 1992 was approximately six. The national average of active cells in 1992 was 2.75, and the national average of inactive cells was 6.05. For hazardous facilities, the average number of cells in 1992 was 7.6, with an average of 4.2 active cells and 8.2 inactive cells. For non-hazardous facilities, the average number of cells in 1992 was 5.7, with an average of 2.5 active cells and 5.4 inactive cells. EPA's survey indicated that there were fewer active landfills in the U.S. than inactive, or closed landfills. As discussed in Section 3.2, a large number of landfills, especially facilities serving small populations, have closed rather than incur the significant expense of complying with RCRA requirements.

The number and type of customers helps to define the size of a landfill. Table 3-6 presents the national estimates of the household and non-household population served by landfills that collect landfill generated wastewater. The total population served by the Landfills industry is 46.3 million household and 5.2 million non-household customers. Non-hazardous landfills serve 99 percent of these customers. Hazardous landfills account for only 307,000 household customers and 170,000 non-household customers. Table 3-7 presents the frequency distributions of the number of household and non-household customers for the non-hazardous and hazardous subcategories as well as for both subcategories combined. Most non-hazardous facilities serve between 100 and 1,000 non-household customers and 10,000 to 100,000 household customers. EPA's survey indicates that hazardous facilities serve between zero and 10,000 non-household customers, but serve very few household customers.

3.2.4 Waste Receipts and Types

Wastes received by landfills in the United States vary from municipal solid waste to highly toxic materials. Table 3-8 presents the national estimates of the types of waste received at landfills and the percentage each waste represents of the total waste received during the following three periods: pre-1980, 1980-1985, and 1986-1992. Sixty-one percent of the waste landfilled during the pre-1980 time period was municipal solid waste and industrial wastes, while 17 percent was commercial solid waste and construction and demolition debris. Similar types of waste were disposed in landfills after 1980; however, the percentage of municipal solid waste and industrial waste decreased, and the amount of commercial solid waste, incinerator residues, PCB/TSCA wastes, and asbestos-containing wastes increased. The disposal in landfills of "other" waste types (such as contaminated soils, auto shredder scrap, and tires) also increased after 1980.

Table 3-9 presents the national estimates of wastes received by the Landfills industry in 1992 by regulatory classification. These data indicate that landfills contained approximately 6.1 billion tons of waste in 1992, and project a future capacity of 8.3 billion tons. However, the estimated future capacity of Subtitle D landfills is much larger than the future capacity of Subtitle C landfills. On average, Subtitle D landfills represent over 97 percent of the future capacity of U.S. landfills.

Table 3-10 presents the national estimates of the annual tonnage of waste accepted by landfills from 1988 through 1992. In 1988, the annual tonnage of waste accepted by Subtitle C and Subtitle D landfills was 221 million tons and, by 1992, the amount of waste accepted annually increased to 315 million tons. The annual tonnage of waste accepted by the entire landfill industry increased 20 percent from 1989 to 1990 and 14 percent from 1990 to 1991. However, when considering Subtitle C landfills alone, EPA's survey found that hazardous landfills experienced a much larger increase in the amount of waste disposed. In 1990, the amount of waste disposed in Subtitle C landfills increased 30 percent from 1989 and, in 1991, the amount of hazardous waste disposed increased 75 percent from 1990. Over the three year period from 1989 to 1991, the annual tonnage of waste landfilled in Subtitle C landfills increased 127 percent. Conversely, the annual tonnage of waste accepted by Subtitle D landfills increased 18 percent from 1989 to 1990 and then increased by only 4 percent from 1990 to 1991. Over the same three year period, from 1989 to 1991, the annual tonnage of waste landfilled in Subtitle D landfills increased by only 23 percent. The greater increase in annual waste deposited in Subtitle C landfills may be the result of more stringent RCRA regulations and stricter waste acceptance criteria (Subtitle C hazardous waste is restricted from being disposed in Subtitle D landfills).

3.2.5 Sources of Wastewater

As noted earlier, a number of landfill operations generate wastewater. In general, the types of wastewater generated by activities include leachate, landfill gas condensate, truck/equipment washwater, drained free liquids, laboratory-derived wastewater, floor washings, storm water, contaminated ground water, and wastewater from recovering pumping wells. Table 3-11 presents the national estimates of the number of landfills that generate each type of wastewater and the minimum, maximum, and median flows. Each of these wastewater sources are discussed below.

3.2.5.1 Landfill Leachate

Landfill leachate is liquid that has passed through or emerged from solid waste and contains soluble, suspended, or miscible materials removed from such waste. Over time, the potential for certain pollutants

to move into the wider environment increases. As water passes through the landfill, it may "leach" pollutants from the disposed waste, moving them deeper into the soil. This presents a potential hazard to public health and the environment through ground water contamination and other means. One measure used to prevent the movement of toxic and hazardous waste constituents from a landfill is a landfill liner operated in conjunction with a leachate collection system. Leachate is typically collected from a liner system placed at the bottom of the landfill. Leachate also may be collected through the use of slurry walls, trenches, or other containment systems. The leachate generated varies from site to site, based on a number of factors including the types of waste accepted, operating practices (including shedding, daily cover and capping), the depth of fill, compaction of wastes, annual precipitation, and landfill age. Based on EPA's survey of the industry, a total of 1,989 landfills generate leachate at flows ranging from one gallon per day to 533,000 gallons per day, with a median daily flow of approximately 5,620 gallons. Landfill leachate is subject to this regulation.

3.2.5.2 Landfill Gas Condensate

Landfill gas condensate is a liquid that has condensed in the landfill gas collection system during the extraction of gas from within the landfill. Gases such as methane and carbon dioxide are generated due to microbial activity within the landfill and must be removed to avoid hazardous, explosive conditions. In the gas collection systems, gases containing high concentrations of water vapor condense in traps staged throughout the gas collection network. The gas condensate contains volatile compounds and accounts for a relatively small percentage of flow from a landfill. The national estimates presented on Table 3-11 report a total of 158 landfills that generate landfill gas condensate at daily flows ranging from 3 gallons to 11,700 gallons. The median flow of landfill gas condensate for the Landfills industry is approximately 343 gallons per day. Landfill gas condensate is subject to the landfills effluent limitations guidelines.

3.2.5.3 Drained Free Liquids

Drained free liquids are aqueous wastes drained from waste containers (e.g., drums, trucks, etc.) or wastewater resulting from waste stabilization prior to landfilling. Landfills that accept containerized waste

may generate this type of wastewater. Wastewater generated from these waste processing activities is collected and usually combined with other landfill generated wastewater for treatment at the wastewater treatment plant. National estimates presented on Table 3-11 identify 33 landfills that generate drained free liquids at a median daily flow of 253 gallons. Daily flows range from a minimum of one gallon per day to a maximum of 82,000 gallons per day. Drained free liquids are subject to the landfills effluent limitations guidelines.

3.2.5.4 Truck and Equipment Washwater

Truck and equipment washwater is generated during either truck or equipment washes at landfills. During routine maintenance or repair operations, trucks and/or equipment used within the landfill (e.g., loaders, compactors, or dump trucks) are washed, and the resultant wastewater is collected for treatment. In addition, it is common practice for many facilities to wash the wheels, body, and undercarriage of trucks used to deliver the waste to the open landfill face upon leaving the landfill. On-site wastewater treatment equipment and storage tanks also are periodically cleaned. It is estimated that 416 landfills generate truck and equipment washwater at a median flow of 118 gallons per day and at daily flows ranging from 5 gallons per day to 15,000 gallons per day.

Floor washings are also generated during routine cleaning and maintenance of landfill facilities. National estimates presented on Table 3-11 indicate there are 70 landfills that generate and collect floor washings at flows ranging from 10 gallons per day to 5,450 gallons per day. The median flow of floor washings for the Landfills industry is approximately 743 gallons per day. Both truck and equipment washwater and floor washings are subject to this rule.

3.2.5.5 Laboratory-Derived Wastewater

Laboratory-derived wastewater is generated from on-site laboratories that characterize incoming waste streams and monitor on-site treatment performance. This source of wastewater is minimal and is usually

combined with leachate and other wastewater prior to treatment at the wastewater treatment plant. Laboratory-derived wastewater is subject to the landfills effluent limitations guidelines.

3.2.5.6 Storm Water

There are two types of storm water, contaminated and non-contaminated. Contaminated storm water is storm water which comes in direct contact with landfill wastes, the waste handling and treatment areas, or wastewater that is subject to the limitations and standards. Some specific areas of a landfill that may produce contaminated storm water include (but are not limited to) the following: the open face of an active landfill with exposed waste (no cover added), the areas around wastewater treatment operations, trucks, equipment or machinery that has been in direct contact with the waste, and waste dumping areas. Non-contaminated (non-contact) storm water is storm water that does not come in direct contact with landfill wastes, the waste handling and treatment areas, or wastewater that is subject to the limitations and standards. Non-contaminated storm water includes storm water which flows off the cap, cover, intermediate cover, daily cover, and/or final cover of the landfill. National estimates indicate that there are 1,135 landfills that generate storm water at flows ranging from 10 gallons per day to 2 million gallons per day, with a median daily flow of approximately 26,800 gallons. Storm water that does not come into contact with the wastes would not be subject to the limitations and standards, as discussed in Chapter 2 of this document.

3.2.5.7 Contaminated Ground Water

Contaminated ground water is water below the land surface in the zone of saturation that has been contaminated by landfill leachate. Contamination of ground water may occur at landfills without liners or at facilities that have released contaminants from a liner system into the surrounding ground water. Ground water also can infiltrate the landfill or the leachate collection system if the water table is high enough to penetrate the landfill area. EPA identified approximately 163 landfills that generate contaminated ground water. Daily flows ranged from 6 gallons per day to 987,000 gallons per day, with a median daily flow of

approximately 12,800 gallons. EPA excluded contaminated ground water from regulation under this guideline as discussed in Chapter 2 of this document.

3.2.5.8 Recovering Pumping Wells

In addition to the contaminated ground water generated during ground water pumping operations, there are various ancillary operations that also generate a wastewater stream. These operations include well construction and development, well maintenance, and well sampling (i.e. purge water). This wastewater will have very similar characteristics to the contaminated ground water. EPA's survey of the Landfills industry identified 50 landfills that generate wastewater from recovering pumping wells. Daily flows range from a minimum of 0.3 gallons to a maximum 80,200 gallons and a median daily flow of 136 gallons. EPA excluded wastewater recovered from pump wells from regulation under this guideline as discussed in Chapter 2 of this document.

3.2.6 Leachate Collection Systems

Most facilities subject to the landfills effluent guidelines generate and collect landfill leachate. To prevent waste material, products of waste decomposition, and free moisture from traveling beyond the limits of the disposal site, landfill facilities utilize some type of leachate collection system. The leachate collection system also reduces the depth of leachate buildup or level of saturation over the liner.

The leachate collection system usually contains several individual components. Two main leachate collection systems may be necessary, an underdrain system and a peripheral system. The underdrain system is constructed prior to landfilling and consists of a drainage system that removes the leachate from the base of the fill. The peripheral system can be installed after landfilling has occurred and, as such, is commonly used as a remedial method. The underdrain system includes a drainage layer of high permeability granular material, drainage tiles to collect the diverted flow laterally, and a low permeability liner underlying the system to retard the leachate that percolates vertically through the unsaturated zone of refuse. Where the leachate meets the low permeability layer, saturated depths of leachate develop and hydraulic gradients govern the leachate flow within the drainage layer (see reference 8).

There are several different types of leachate collection systems employed by the Landfills industry. Table 3-12 presents the different types of leachate collection systems and the national estimates of the number of landfills which employ each system. A simple gravity flow drain field is the most basic and commonly used type of collection system, employed by 50 percent of the industry. According to EPA's 1992 survey, compound leachate collection systems consisting of a liner system and collection pipes are used by 20 percent of the industry. French drains, which are gravel channels used to facilitate leachate drainage, are used by 15 percent of the landfills in the U.S. Other types of leachate collection systems utilized by 10 percent of the Landfills industry include collection sumps and risers, combined gas/leachate extraction wells, perforated toe drains to pump stations, and gravity flow in pipes to a holding pond, basin, or pump station to storage tanks.

3.2.7 Pretreatment Methods

Several types of waste accepted by landfills for disposal may require some type of pretreatment. Wastes that may require pretreatment include free liquids, containerized waste, and bulk wastes. Free liquids may be drained, removed, or stabilized. Containerized waste and bulk wastes may be shredded, stabilized, or solidified. Table 3-13 presents the types of pretreatment methods currently in use by the Landfills industry and national estimates of the number of landfills that pretreat these wastes.

Approximately 75 percent of non-hazardous landfills do not accept free liquids and, of those that do, 20 percent do not pretreat the liquids before treatment at an on-site wastewater treatment facility or treatment off site. In comparison, approximately 65 percent of hazardous landfills accept free liquids and pretreat by stabilizing, draining, or removing the liquid. Forty percent of non-hazardous landfills accept containerized waste, compared to almost 75 percent of hazardous landfills. The most common type of pretreatment for containerized waste is solidification followed by stabilization. Most landfills accept bulk wastes, although many facilities do not pretreat this type of waste. Bulk wastes are usually treated by stabilization or solidification and stabilization. Other types of pretreatment for bulk wastes include compaction, chemical treatment, flocculation, macro/microencapsulation, and recycling.

3.2.8 Baseline Treatment

Many landfills in the United States currently have wastewater treatment systems in place. The most common treatment system used to treat landfill wastewater is biological treatment. However, chemical precipitation and combinations of biological treatment, chemical precipitation, equalization, and filtration also are used widely. Table 3-14 presents the types of treatment and the national estimates of the number of landfills in the industry that employ each type of wastewater treatment. As expected, indirect and zero dischargers often do not employ on-site treatment because they either ship their wastewater off site or use alternate disposal methods such as deep well injection, incineration, evaporation, land application, or recirculation. Chapter 8 presents a detailed discussion of treatment technology and performance.

EPA's survey of the Landfills industry solicited wastewater treatment facility operating information from non-hazardous and hazardous landfills. Table 3-15 presents the national estimates of the number of landfill facilities that operate wastewater treatment systems between 1 and 24 hours per day. Direct and zero or alternative discharge facilities tend to operate treatment systems continuously, whereas many indirect discharge facilities operate less than 24 hours per day. Table 3-16 presents the average daily hours of operation of a typical on-site wastewater treatment facility. Table 3-17 presents the national estimates of the number of landfill facilities that operate wastewater treatment systems between 1 and 7 days per week. Again, direct and zero or alternative discharge facilities commonly operate their treatment systems continuously, whereas indirect dischargers do not. Table 3-18 presents the average number of days per week a typical wastewater treatment facility is in operation.

3.2.9 Discharge Types

EPA's Detailed Technical Questionnaire identified landfills that discharged wastewater directly to a surface water, indirectly to POTWs, and others that disposed of their landfill wastewater through zero or alternative discharge. Direct discharge facilities are those that discharge their wastewater directly to a receiving stream or body of water. Indirect discharging facilities discharge their wastewater indirectly to a POTW. Zero or alternative discharge facilities use treatment and disposal practices that result in no discharge of

wastewater to surface waters. Zero or alternative disposal options for landfill generated wastewater include off-site treatment at another landfill wastewater treatment system or a Centralized Waste Treatment facility, deep well injection, incineration, evaporation, land application, solidification, and recirculation.

Table 3-19 presents the national estimates of the number of landfill facilities grouped by discharge type. These estimates show that the majority of non-hazardous facilities responding to the survey were indirect dischargers, whereas the majority of hazardous facilities were zero dischargers. Although EPA identified hazardous landfills discharging directly to surface waters, none of these facilities are subject to the landfills effluent limitations guidelines.

Table 3-1: Number of Landfills per U.S. State

State	Subtitle D Landfills	Subtitle C Landfills	Total Landfills
Alabama	238	38	276
Alaska	201	1	202
Arizona	90	2	92
Arkansas	134	3	137
California	630	16	646
Colorado	216	12	228
Connecticut	125	22	147
Delaware	8	14	22
Florida	91	9	100
Georgia	277	17	294
Hawaii	15	1	16
Idaho	112	6	118
Illinois	182	14	196
Indiana	101	29	130
Iowa	118	13	131
Kansas	118	8	126
Kentucky	121	33	154
Louisiana	73	17	90
Maine	291	2	293
Maryland	50	5	55
Massachusetts	722	1	723
Michigan	762	9	771
Minnesota	257	4	261
Mississippi	97	3	100
Missouri	128	7	135
Montana	257	1	258
Nebraska	41	8	49
Nevada	127	3	130
New Hampshire	58	0	58
New Jersey	467	8	475
New Mexico	121	7	128
New York	565	10	575
North Carolina	244	39	283
North Dakota	85	1	86
Ohio	119	24	143
Oklahoma	189	7	196
Oregon	231	10	241
Pennsylvania	41	22	63
Rhode Island	12	0	12
South Carolina	127	9	136
South Dakota	193	0	193
Tennessee	112	9	121
Texas	601	70	671
Utah	92	7	99
Vermont	73	0	73
Virginia	440	8	448
Washington	72	9	81
West Virginia	57	5	62
Wisconsin	183	3	186
Wyoming	218	45	263
Puerto Rico	0	3	3
Guam	0	1	1
Total	9,882	595	10,477

Table 3-2: Ownership Status of Landfill Facilities

Ownership Status	Number of Landfill Facilities		
	Subtitle D Non-Hazardous Subcategory	Subtitle C Hazardous Subcategory	Industry Total
Commercial	506	171	677
Non-Commercial (intra-company)	5	48	53
Non-Commercial (captive)	121	94	215
Municipal	708	2	710
Federal Government	4	2	6
Government (other than Federal or Municipal)	0	0	0
Indian Tribal Interest	0	0	0
Other	1	0	1
Total	1,345	317	1,662

Table 3-3: Total Landfill Facility Area

Facility Land Type	Landfill Facility Area (acres)		
	Subtitle D Non-Hazardous Subcategory	Subtitle C Hazardous Subcategory	Industry Total
Total Facility Area	416,733	309,194	725,927
Wastewater Treatment Area	9,424	10,147	19,571
Waste Disposal Area (landfill)	119,700	16,552	136,323
Undeveloped Land	254,610	207,085	459,811

Table 3-4: Landfill Facility Land Area Ranges

Subcategory	Land Area Range (acres)	Number of Landfill Facilities			
		Total Facility Area	Wastewater Treatment Area	Waste Disposal Area (landfill)	Undeveloped Land
All Facilities	0	0	747	28	110
	>0-1	0	320	16	2
	>1-10	9	437	126	69
	>10-100	490	136	1,128	561
	>100-1,000	1,044	22	362	745
	>1,000-10,000	119	0	0	85
	Total	1,662	1,662	1,660	1,662
Subtitle C Hazardous	0	0	38	5	49
	>0-1	0	128	14	0
	>1-10	2	70	47	2
	>10-100	95	65	199	99
	>100-1,000	136	15	52	106
	>1,000-10,000	84	0	0	60
	Total	317	316	317	316
Subtitle D Non-Hazardous	0	0	708	23	61
	>0-1	0	191	2	2
	>1-10	7	366	79	67
	>10-100	395	72	930	551
	>100-1,000	909	7	310	638
	>1,000-10,000	34	0	0	25
	Total	1,345	1,344	1,344	1,344

Table 3-5: Number of Landfill Cells

Subcategory	Type of Landfill Cell	Number of Cells	
		Estimated Mean	Estimated Total
All Facilities	Total cells	6.12	13,299
	Active cells	2.75	4,608
	Inactive cells	6.05	8,690
Subtitle C Hazardous	Total cells	7.64	3,776
	Active cells	4.23	1,112
	Inactive cells	8.24	2,663
Subtitle D Non-Hazardous	Total cells	5.68	9,523
	Active cells	2.48	3,496
	Inactive cells	5.41	6,027

Table 3-6: Household and Non-Household Population Served

Population Served	Number of Customers		
	Subtitle D Non-Hazardous Subcategory	Subtitle C Hazardous Subcategory	Industry Total
Non-Household	5,043,542	170,420	5,213,962
Household	46,007,775	307,243	46,315,018

Table 3-7: Household vs. Non-Household Customers

Number of Non-Household Customers	Number of Landfill Facilities		
	Subtitle D Non-Hazardous Subcategory	Subtitle C Hazardous Subcategory	Industry Total
0	76	123	205
1	83	40	124
>1-10	33	12	45
>10-100	202	4	203
>100-1,000	544	87	628
>1,000-10,000	351	51	400
>10,000-100,000	55	0	54
>100,000-1,00,000	2	0	2
Total	1,346	317	1,661
Number of Household Customers			
0	180	313	506
1	0	0	0
>1-10	55	0	55
>10-100	29	0	28
>100-1,000	42	0	42
>1,000-10,000	195	2	195
>10,000-100,000	742	0	733
>100,000-1,00,000	102	2	103
Total	1,345	317	1,662

Table 3-8: Wastes Received by Landfills in the United States

Waste Type	Mean % for Time Period Pre-1980	Mean % for Time Period 1980-85	Mean % for Time Period 1986-92
Municipal Solid Waste	38.3	33.4	33.9
Household Hazardous Waste	0.217	0.218	0.215
Yard Waste	4.76	4.39	3.76
Commercial Solid Waste	8.56	9.92	9.94
Institutional Wastes	1.36	1.43	2.14
Industrial Wastes	22.8	19.6	17.4
Agricultural Waste	0.340	0.297	0.284
Pesticides	0.033	0.009	0.321
PCB, TSCA Wastes	0.192	1.12	0.980
Asbestos-Containing Waste	0.905	3.73	3.42
Radioactive Waste	0.019	0.002	0.001
Medical or Pathogenic Waste	0.255	0.182	0.123
Superfund Clean-Up Wastes	0.000	0.021	0.014
Mining Wastes	0.519	0.47	0.180
Incinerator Residues	1.01	1.43	3.14
Fly Ash, Not Incinerator Waste	4.49	5.82	6.30
Construction/Demolition Debris	8.40	5.91	7.95
Sewage Sludge	1.81	3.15	2.88
Dioxin Waste	0.000	0.039	0.024
Other Sludge	4.89	4.90	2.91
Other Waste Types	1.23	4.49	5.25
Industry Total	100.09	100.528	101.132

Table 3-9: Total Volume of Waste Received by Landfills in 1992 by Regulatory Classification

Time Frame	Regulatory Class	All Facilities		Subtitle C Hazardous Subcategory		Subtitle D Non-Hazardous Subcategory	
		Estimated Total Number Landfills	Total Volume Landfilled (tons)	Estimated Total Number Landfills	Total Volume Landfilled (tons)	Estimated Total Number Landfills	Total Volume Landfilled (tons)
Current	Pre 1980	561	954,273,421	190	155,418,921	370	798,854,500
	RCRA Subtitle C	333	159,252,888	323	158,994,443	10	258,445
	RCRA Subtitle D	906	1,501,319,521	115	249,656,514	791	1,251,663,007
	TSCA	108	53,167,884	102	52,654,468	6	513,416
	NRC	.	.	.	.	.	.
	Local Regulation	461	2,365,983,720	57	6,374,393	404	2,359,609,326
	CERCLA	4	10,507,627	2	72,587	2	10,435,040
	Other Regulation	560	1,018,656,724	114	36,250,349	446	982,406,374
	Total Volume Landfilled	2,146	6,063,161,789	491	659,421,679	1,655	5,403,740,110
			Future Capacity (tons)		Future Capacity (tons)		Future Capacity (tons)
Future	Pre 1980	86	101,032,485	.	.	86	101,032,485
	RCRA Subtitle C	201	66,313,422	193	65,192,737	8	1,120,685
	RCRA Subtitle D	884	6,056,763,187	33	96,321,683	851	5,960,441,504
	TSCA	34	11,202,929	28	10,897,045	6	305,884
	NRC	2	300,860	.	.	2	300,860
	Local Regulation	293	962,479,373	57	4,710,196	236	957,769,177
	CERCLA	50	4,297,618	50	4,297,618	.	.
	Other Regulation	501	1,126,823,595	127	30,749,439	374	1,096,074,156
	Total Volume Landfilled	1,706	8,329,213,474	266	212,168,721	1,441	8,117,044,753

Table 3-10: Annual Tonnage of Waste Accepted by Landfills

Year	Annual Tonnage of Waste (tons)		
	Subtitle D Non-Hazardous Subcategory	Subtitle C Hazardous Subcategory	Industry Total
1988	185,184,608	36,305,235	221,489,843
1989	196,377,576	28,867,681	225,245,257
1990	232,535,432	37,413,692	269,949,125
1991	241,454,300	65,402,768	306,857,068
1992	252,101,069	63,022,850	315,123,919

Table 3-11: Wastewater Flows Generated by Individual Landfills

Type of Wastewater Generated	Number of Landfills	Minimum Average Flow (gal/day)	Maximum Average Flow (gal/day)	Industry Median (gal/day)
Floor washing	70	10	5,450	743
Landfill leachate	1,989	1	533,000	5,620
Contaminated ground water	163	6	987,000	12,800
Storm water run-off	1,135	10	2,067,000	26,800
Landfill gas condensate	158	3	11,700	343
Recovering pumping wells	50	0.3	80,200	136
Truck/equipment washwater	416	5	15,000	118
Drained free liquids	33	1	82,000	253
Other	2	0	0	0
Total	4,016			

Table 3-12: Type of Leachate Collection Systems Used at Individual Landfills

Type of Leachate Collection	Number of Landfills		
	Subtitle D Non-Hazardous Subcategory	Subtitle C Hazardous Subcategory	Industry Total
None	46	87	132
Simple Gravity Flow Drain Field	977	266	1,242
French Drain System	341	38	379
Compound Leachate Collection	416	93	509
Suction Lysimeters	0.	2	2
Other	196	49	246
Total	1,976	535	2,510

Table 3-13: Pretreatment Methods in Use at Individual Landfills

Type of Waste	Pretreatment Method	Number of Landfills		
		Subtitle D Non-Hazardous Subcategory	Subtitle C Hazardous Subcategory	Industry Total
Free Liquids	No Pretreatment	324	113	437
	None Accepted	1,277	283	1,560
	Drained or Removed	51	115	166
	Stabilization	38	172	211
	Other	17	84	101
	Total	1,707	767	2,475
Containerized Waste	No Pretreatment	515	100	616
	None Accepted	1,008	180	1,188
	Shredded	23	70	94
	Stabilized	6	135	141
	Solidified	41	138	179
	Other	110	80	190
	Total	1,703	703	2,408
Bulk Wastes	No Pretreatment	993	216	1,209
	None Accepted	414	61	475
	Baled	33	2	35
	Shredded	82	49	131
	Stabilized	15	201	216
	Solidified	74	126	200
	Other	100	38	138
	Total	1,711	693	2,404

Table 3-14: Types of Wastewater Treatment Employed by the Landfills Industry

Type of Treatment	Number of Landfills		
	Direct Discharge	Indirect Discharge	Zero Discharge
No treatment	81	691	468
Biological treatment	119	37	19
Chemical precipitation	63	45	8
Chemical precipitation and biological treatment	32	10	0
Filtration and biological treatment	45	4	5
Equalization and biological treatment	65	28	7
Equalization, biological treatment, and filtration	37	4	5
Equalization, chemical precipitation, and biological treatment	26	8	0
Equalization, chemical precipitation, biological treatment, and filtration	26	2	0

Table 3-15: Wastewater Treatment Facility Hours of Operation per Day

Hours of Operation (hours/day)	Subtitle D Non-Hazardous Subcategory			Subtitle C Hazardous Subcategory			Industry Total		
	Direct	Indirect	Zero	Direct	Indirect	Zero	Direct	Indirect	Zero
0	0	0	0	0	0	0	0	0	0
1-23	11	295	40	11	4	6	23	275	42
24	161	508	330	122	20	153	283	552	488
Total	172	803	370	133	24	159	306	827	530

Table 3-16: Wastewater Treatment Facility Average Hours of Operation per Day

Subcategory	Average Hours of Operation/Day		
	Direct Discharge	Indirect Discharge	Zero Discharge
All Facilities	22.80	19.16	22.55
Subtitle C Hazardous	22.78	22.18	23.46
Subtitle D Non-Hazardous	22.83	18.52	21.89

Table 3-17: Wastewater Treatment Facility Days of Operation per Week

Days of Operation (days/week)	Subtitle D Non-Hazardous Subcategory			Subtitle C Hazardous Subcategory			Industry Total		
	Direct	Indirect	Zero	Direct	Indirect	Zero	Direct	Indirect	Zero
0	0	0	0	0	0	0	0	0	0
1-6	7	225	40	19	2	6	30	203	42
7	165	578	330	115	22	153	275	624	488
Total	172	803	370	134	24	159	305	827	530

Table 3-18: Wastewater Treatment Facility Average Days of Operation per Week

Subcategory	Average Days of Operation/Week		
	Direct Discharge	Indirect Discharge	Zero Discharge
All Facilities	6.72	6.47	6.81
Subtitle C Hazardous	6.56	6.83	6.77
Subtitle D Non-Hazardous	6.94	6.39	6.84

Table 3-19: Total Number of Facilities by Discharge Type

Subcategory	Discharge Type			Total
	Direct	Indirect	Zero	
All Facilities	306	827	529	1,662
Subtitle C Hazardous	134	24	159	317
Subtitle D Non-Hazardous	172	803	370	1,345

Figure 3-1: Development of National Estimates for the Landfills Industry